



# nuclear technology®

MID-AUGUST 1977 - VOL. 35, NO. 1

116

EDITOR:

**ROY G. POST**

Department of Nuclear Engineering  
University of Arizona  
Tucson, Arizona 85721

ASSOCIATE EDITOR:

**KARL WIRTZ**

Kernforschungszentrum Karlsruhe  
Institut für Neutronenphysik und Reaktortechnik  
75 Karlsruhe, Postfach 3640, Germany

**VOLUME 35**

**Mid-August, September,**

**October 1977**

**AMERICAN NUCLEAR SOCIETY**

555 NORTH KENSINGTON AVENUE • LA GRANGE PARK, ILLINOIS 60525 USA

# Nuclear Technology

EDITOR

ROY C. POST

Department of Nuclear Engineering  
University of Illinois  
Urbana, Illinois 61801

ASSOCIATE EDITOR

KARL WATTS

Department of Nuclear Engineering  
University of Illinois  
Urbana, Illinois 61801

Copyright © 1977 by American Nuclear Society, Inc., La Grange Park, Illinois 60525

VOLUME 32

Mid-August, September,

October 1977

AMERICAN NUCLEAR SOCIETY

30 NORTH KENYON AVENUE • LA GRANGE PARK, ILLINOIS 60525 USA

# CONTENTS OF VOLUME 35

MID-AUGUST 1977—VOL. 35, NO. 1

## NT LETTER

- 9 Creep-Rupture Properties of 20% Cold-Worked Type 316 Stainless Steel After High Fluence Neutron Irradiation / *R. L. Fish*

## TECHNICAL PAPERS

### REACTORS

- 12 A Mathematical Model for an Integral Economizer U-Tube Steam Generator / *D. C. Arwood, T. W. Kerlin*
- 33 Thermal Shock Effects in Fast Burst Reactors / *G. P. Mulholland, T. F. Luera, A. De La Paz*
- 40 Isotopic Enrichment of Plasma Exhausts from Controlled Thermonuclear Reactors by Cryogenic Distillation / *Balabhadra Misra, Victor A. Maroni*
- 51 Nuclear Analysis of a Tokamak Experimental Power Reactor Conceptual Design / *Mohamed A. Abdou, Jungchung Jung*
- 80 Migration of Metallic Fission Products in Reactor Oxide Fuels / *F. D'Annuncci, C. Sari, G. Schumacher*

### REACTOR SITING

- 87 The Importance of Heat Transfer in Hypothetical Core Disruptive Accident Analysis / *Paul B. Abramson*

### CHEMICAL PROCESSING

- 97 Basis for Subcritical Limits in Proposed Criticality Safety Standard for Mixed Oxides / *E. D. Clayton, H. K. Clark, D. W. Magnuson, J. H. Chalmers, Gordon Walker, N. Ketzlach, Ryohei Kiyose, C. L. Brown, D. R. Smith, R. Artigas*
- 112 Neutron Multiplication and Shielding Problems in Pressurized Water Reactor Spent Fuel Shipping Casks / *C. Devillers, P. Blum*

(Continued)



# CONTENTS OF VOLUME 35 *continued*

MID-AUGUST 1977—VOL. 35, NO. 1

(Continued)

## FUELS

- 119 Probability Distributions of Peak-Clad Temperature and Cladding Oxidation Thickness in Loss-of-Coolant Accidents for a Typical Boiling Water Reactor / *T. Shimooke, K. Matsumoto*
- 131 On the Pellet-Cladding Interaction Phenomenon / *J. T. A. Roberts, E. Smith, N. Fuhrman, D. Cubicciotti*
- 145 Simulation Study of the Restructuring of Advanced Fuel Heated in a Radial Temperature Gradient / *C. Sari*
- 154 Study of Uranium-Plutonium Carbide-Based Fuel Simulating High Burnup / *U. Benedict, G. Giacchetti, H. Matzke, K. Richter, C. Sari, H. E. Schmidt*

## ECONOMICS

- 162 Simulation of the Nuclear Power Economy / *Mark B. Triplett*

## MATERIALS

- 173 Basic Compatibility Studies of Advanced Fuels with 3d Transition Metals / *E. C. Beahm, C. A. Culpepper*

## SHIELDING

- 178 Methods of Shield Analysis for Protection Against Electrons in Space / *John W. Wilson, Fred M. Denn*

## TECHNICAL NOTE

## REACTORS

- 184 On the Effective Temperature of an Expanding Tube with a Radial Temperature Gradient over the Wall / *W. van Witzenburg, L. G. J. Janssen, J. Prij*

## DEPARTMENTS

- 1 Authors
- 188 Corrigendum

# CONTENTS OF VOLUME 35 *continued*

SEPTEMBER 1977—VOL. 35, NO. 2

## COATED PARTICLE FUELS

- 205 Foreword: Coated Particle Fuels / *The Editor*  
206 Preface: Coated Particle Fuels / *T. D. Gulden, H. Nickel*

### FABRICATION

- 217 Processing and Composition Control of Weak-Acid-Resin-Derived Fuel Microspheres / *G. W. Weber, R. L. Beatty, V. J. Tennery*  
227 Improved Gas Distributor for Coating High-Temperature Gas-Cooled Reactor Fuel Particles / *W. J. Lackey, D. P. Stinton, J. D. Sease*  
238 Coated Fuel Particles: Requirements and Status of Fabrication Technology / *H. Huschka, P. Vygen*  
246 Nuclear Fuel Coated Particle Development in the Reactor Fuel Element Laboratories of the U.K. Atomic Energy Authority / *P. L. Allen, L. H. Ford, J. V. Shennan*

### PYROCARBON

- 257 Fundamentals on the Agglomerate Model and Its Relation to the Physical Properties of Pyrocarbon / *J. Linke, K. Koizlik, H. Nickel*  
263 Coated Nuclear Fuel Particles: The Coating Process and Its Model / *R. L. R. Lefevre, M. S. T. Price*  
279 Automatic Size Analysis of Coated Fuel Particles / *K. Wallisch, P. Koss*  
284 Quality Control Techniques for Pyrocarbon / *W. Delle, K. Koizlik, M. S. T. Price, E. Wallura*  
293 A Quantitative Chemical Method for the Determination of the Disordered Carbon Component in Pyrocarbon Coatings of Fuel Particles / *E. A. Wolfrum, H. Nickel*  
301 Transmission Electron Microscopy of Pyrocarbon Coatings / *E. Pollmann, J. Pelissier, C. S. Yust, J. L. Kaae*  
310 Influence of Porosity on the Irradiation Performance of Pyrocarbon Coatings / *P. Krautwasser, H. Nickel*  
320 Properties of Silicon Carbide for Nuclear Fuel Particle Coatings / *R. J. Price*  
337 Preliminary Examination of the Helium Permeability of Pyrocarbon Coatings / *C. S. Morgan, G. L. Powell*

(Continued)



# CONTENTS OF VOLUME 35 *continued*

SEPTEMBER 1977—VOL. 35, NO. 2

(Continued)

## PERFORMANCE AND PERFORMANCE MODELING

- 343 Properties Influencing High-Temperature Gas-Cooled Reactor Coated Fuel Particle Performance / *D. P. Harmon, C. B. Scott*
- 353 Neutron-Induced Permeability of Pyrocarbon-Coated High-Temperature Gas-Cooled Reactor Fuel Particles / *R. A. Bradley, B. A. Thiele*
- 359 The Mechanical Behavior of Biso-Coated Fuel Particles During Irradiation. Part I: Analysis of Stresses and Strains Generated in the Coating of a Biso Fuel Particle During Irradiation / *J. L. Kaae*
- 368 The Mechanical Behavior of Biso-Coated Fuel Particles During Irradiation. Part II: Prediction of Biso Particle Behavior During Irradiation with a Stress-Analysis Model / *J. L. Kaae, R. E. Bullock, C. B. Scott, D. P. Harmon*
- 379 Improvement of a Method for Predicting Failure Rates of Coated Particles During Irradiation / *Karl Bongartz*
- 386 Restoration of Carbon Monoxide Equilibrium in Porous Oxide High-Temperature Reactor Fuel Particles / *A. Strigl, E. Proksch*
- 392 Amoeba Behavior of  $\text{UO}_2$  Coated Particle Fuel / *M. Wagner-Löffler*
- 403 Migration of  $\text{ThO}_2$  Kernels Under the Influence of a Temperature Gradient / *C. L. Smith*
- 413 Silicon Carbide Corrosion in High-Temperature Gas-Cooled Reactor Fuel Particles / *H. Grübmeier, A. Naoumidis, B. A. Thiele*
- 428 Stoichiometric Effects on Performance of High-Temperature Gas-Cooled Reactor Fuels from the U-C-O System / *F. J. Homan, T. B. Lindemer, E. L. Long, Jr., T. N. Tiegs, R. L. Beatty*
- 442 Irradiation Performance of Fort St. Vrain High-Temperature Gas-Cooled Reactor Fuel in Capsule F-30 / *C. B. Scott, D. P. Harmon*

## FISSION PRODUCT RELEASE

- 457 Cesium Release and Transport in Biso-Coated Fuel Particles / *M. T. Morgan, A. P. Malinauskas*
- 465 Cesium Release Data for Biso-Coated Particles / *D. Stöver, R. Hecker*
- 475 Release of Metallic Fission Products from Multilayered Coated Particles / *P. D. Smith, R. G. Steinke, D. D. Jensen, T. Hama*
- 483 Silver Release from Coated Particle Fuel / *H. Nabielek, P. E. Brown, P. Offermann*

(Continued)

# CONTENTS OF VOLUME 35 *continued*

SEPTEMBER 1977—VOL. 35, NO. 2

(Continued)

- 494 Emission of Fission Gases by Failed Coated Oxide Fuel Particles / *Marie-Louise Pointud, Pierre Chenebault*
- 501 Fission Gas Release from Fuel Particles and Fuel Rods / *B. F. Myers, N. L. Baldwin, W. E. Bell*
- 509 Fission Product Release from Coated Particles Embedded in Spherical Fuel Elements for High-Temperature Reactors / *E. Groos, G. Mielken, R. Duwe, A. Müller, M. Will*
- 516 Release of Rare Fission Gases from Spherical Elements with Coated Fuel Particles / *K. Röllig*

## ADVANCED AND IMPROVED FUELS AND APPLICATIONS

- 527 Chemical Vapor Deposition of ZrC Made by Reactions of  $ZrCl_4$  with  $CH_4$  and with  $C_3H_6$  / *C. M. Hollabaugh, L. A. Wahman, R. D. Reiswig, R. W. White, P. Wagner*
- 536 Improvements in the Performance of Nuclear Fuel Particles Offered by Silicon-Alloyed Carbon Coatings / *J. L. Kaae, S. A. Sterling, L. Yang*
- 548 Metallic Fission Product Retention of Coated Particles with Ceramic Kernel Additives / *R. Förthmann, H. Grübmeier, D. Stöver*
- 557 Coated Particle Fuel Element for Pressurized Water Reactors / *Werner Katscher*

## CONCLUSION

- 567 Concluding Remarks: Coated Particle Fuels / *H. Nickel, T. D. Gulden*

## DEPARTMENT

- 189 Authors



# CONTENTS OF VOLUME 35 *continued*

OCTOBER 1977—VOL. 35, NO. 3

## NT LETTER

- 579 Progress on the Full-Scale Testing Program / *Robert M. Jefferson*

## TECHNICAL PAPERS

### REACTORS

- 581 A Technical Scale Gas Generator for Steam Gasification of Coal Using Nuclear Heat / *H. Jüntgen, K. H. van Heek*
- 591 SOPHT—A Computer Model for CANDU-PHWR Heat Transport Networks and Their Control / *Charles Yung Fen Chang, John Skears*
- 603 The Effect of Internal Circulation on the Heat Transfer of a Nuclear Reactor Containment Spray Droplet / *J. N. Chung, P. S. Ayyaswamy*

### REACTOR SITING

- 611 Fission and Explosive Energy Releases of  $\text{PuO}_2$ ,  $\text{PuO}_2\text{-UO}_2$ ,  $\text{UO}_2$ , and  $\text{UO}_3$  Assemblies / *J. J. Koelling, G. E. Hansen, C. C. Byers*

### FUELS

- 617 A Generalized Parametric Model for Transient Gas Release and Swelling in Oxide Fuels / *E. E. Gruber*
- 635 Thorium-Based Fuels in Fast Breeder Reactors / *Bal Raj Sehgal, Joseph A. Naser, Ching-lu Lin, Walter B. Loewenstein*

### MATERIALS

- 651 Transport of Deuterium in Nb—1 wt% Zr / *R. M. Alire*
- 656 Interactions of Refractories and Reactor Materials with Sodium / *J. K. Fink, J. J. Heiberger, R. Kumar, R. A. Blomquist*

### TECHNIQUES

- 663 In-Line Determination of Fissile Material in High-Activity Solutions / *G. Schulze, H. Würz*

(Continued)



# CONTENTS OF VOLUME 35 *continued*

OCTOBER 1977—VOL. 35, NO. 3

(Continued)

## TECHNICAL NOTE

### REACTORS

- 671 Elastic-Plastic Analysis of Pressurized Ducts with Rounded Corners / *H. J. Petroski*

## DEPARTMENTS

- 575 Authors
- 677 Volume 35 Indexes

